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Title	A NEW GENUS OF GRACILLARIIDAE, WITH THREE NEW SPECIES FROM ASIA (LEPIDOPTERA)
Author(s)	KUMATA, Tosio
Citation	Insecta matsumurana. Series entomology. New series, 32: 109-137
Issue Date	1985-10
Doc URL	<a href="http://hdl.handle.net/2115/9831">http://hdl.handle.net/2115/9831</a>
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A NEW GENUS OF GRACILLARIIDAE, WITH THREE NEW  
SPECIES FROM ASIA (LEPIDOPTERA)

By TOSIO KUMATA

Research Trips for Agricultural and Forest Insects in the Subcontinent of India [Grants-in-Aid for Overseas Scientific Survey, Ministry of Education, Japanese Government, 1978, No. 304108; 1979, No. 404307; 1983, No. 58041001; 1984, No. 59043001], Scientific Report No. 20.

*Abstract*

KUMATA, T. 1985. A new genus of Gracillariidae, with three new species from Asia (Lepidoptera). *Ins. matsum. n. s.* 32: 109-137, 16 figs. (2 text-figs., 14 pls.).

A new genus, *Artifodina*, which is related to the genus *Acrocercops*, is described, with 3 new species: *A. japonica* (leaf-miner of *Myrsine seguinii*) from Japan (Honsyū; Sikoku), *A. strigulata* (leaf-miner of *M. capitellata*) from Northeast India and Nepal, and *A. himalaica* (leaf-miner of *M. semiserrata*) from Nepal. Larval instars are also described so far as available.

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## INTRODUCTION

In the course of my taxonomic work on the Japanese Gracillariidae I obtained a peculiar leaf-miner occurring on *Myrsine seguinii* in southern Japan. This leaf-miner is quite similar to some members of the genus *Acrocercops* in the adult structure, but unusually has 5 pairs of prolegs in the last instar larva. This puzzled me over the taxonomic position of the species, because it has generally been accepted that the larvae of the family Gracillariidae are characterized by the presence of 4 pairs of prolegs in the last instar. According to Peterson (1951, p. 89) "prolegs when present occur on segments 3, 4, 5 and 10, and the absence of prolegs on the 6th segment is distinctive" to the Gracillariidae.

In 1978 and 1983 I had the chances to make collecting trips to India and Nepal as a member of the project "Research Trips for Agricultural and Forest Insects in the Subcontinent of India". In these trips I collected 2 other species forming leaf-mines on *Myrsine capitellata* and *M. semiserrata*. These leaf-miners are closely related to the Japanese species in question. Moreover, at least one of them has 5 pairs of prolegs in the last instar larva likewise. To my regret, I failed to secure material of the last instar larva for the other species.

After my careful examination I have come to conclude that all these species undoubtedly belong to the family Gracillariidae and that a new genus should be erected for the reception of them. The presence of 5 pairs of larval prolegs is surely peculiar for gracillariid species, but it is an ordinary state in most families of Lepidoptera. The new genus might, therefore, remain in a generalized or primitive state. However, in other characters, such as larval chaetotaxy and larval transformation, the new genus is more similar to the moderately advanced genus *Acrocercops* rather than to the supposedly primitive genus *Macarostola* or *Gracillaria* (for the characters of these genera, see Kumata, 1977, '78, '82). Moreover, in the adult stage the new genus is very close to *Acrocercops* in many respects as discussed under the generic description. It seems that in the Gracillariidae the occurrence of larval prolegs on the 6th abdominal segment is a novel but possibly atavistic state. It is the opinion here adopted that the 6th abdominal prolegs were once lost in the early evolutional process of the family.

The 3 species considered are also new to science, and will be described herein-after. All the specimens used in this paper were collected by me; most of them, including the holotypes, are deposited in the collection of the Entomological Institute, Hokkaidō University, and others are to be distributed as follows: — Three adults collected from India are to be deposited in the collection of Zoological Survey of India, Calcutta; and 8 ones collected from Nepal, in the collection of the Entomology Division, Department of Agriculture, Nepalese Government, Kathmandu.

## SUBFAMILY GRACILLARIINAE

### Genus *Artifodina* nov.

Type-species: *Artifodina japonica* sp. nov.

*Adult.*

♂ ♀: Head and face smooth-scaled; ocelli absent; proboscis developed.

Maxillary palpi short, about 3/4 as long as diameter of eye, slightly rough-scaled, divergent apically, but bent mesad near apex. Labial palpi drooping, moderate in length, smooth-scaled; apical segment a little shorter than the 2nd, slightly upcurved, pointed apically. Antenna filiform, about 1.1 to 1.2 times as long as fore wing, simple in both sexes; scape slightly thickened, without hairy pecten or scaly tuft. Thorax smooth, without dorsal crest. Legs slender, smooth; hind tibia with a series of short, bristly scales above, and with 2 pairs of spurs, the anterior pair at basal 1/5; hind tarsus about 1.3 times as long as hind tibia, the 1st segment having a row of very short, bristly scales above, or lacking such scales in *A. himalaica* sp. nov. Fore wing (Fig. 4) narrowly lanceolate, bluntly pointed apically; discoidal cell occupying about basal 3/4 of wing, dilated apically, obliquely truncated; 12- or 13-veined,  $Cu_{1b}$  completely absent in type-species, or obsolescent towards its base in other species; all the veins well separated at their bases, or  $R_2$  and  $R_3$  connate basally in *A. himalaica* sp. nov.;  $R_1$  running from basal 2/5 of cell to basal 3/5 of costa of wing;  $R_2$  and  $R_3$  arising around upper angle of cell;  $R_s$  from middle of terminal margin of cell;  $M_1$ ,  $M_2$ ,  $M_3$  and  $Cu_{1a}$  around lower angle of cell;  $Cu_2$  rudimentary and prominent on its apical part alone; anal vein simple, short, connected with dorsal margin at about basal 1/6 of wing. Hind wing about half as wide as and 8/10 as long as fore wing, with complete venation; discoidal cell opened between  $M_2$  and  $M_3$ ;  $M_1$  and  $M_2$  stalked;  $M_3$  and  $Cu_{1a}$  long-stalked, with their common stem stalked with  $Cu_{1b}$ ; in one specimen of type-species,  $Rs$  abnormally branched off into 2 veins (Fig. 4, B).

Male genitalia: Tegumen rather simple, without gnathos and socii, the lateral faces being sclerotized on basal 2/3 and sometimes forming a pair of lobes at middle of tegumen; subscaphium of tuba analis strongly sclerotized, sometimes forming an acute hook at basal extremity. Valva somewhat wing-shaped, with a comb of moderate length on cucullus as in *Acrocercops*-species; outer surface covered with long androconial scales. Vinculum small, V-shaped, with a long, narrow saccus, and with a group of short and club-shaped setae on cephalic side. Aedeagus tubular, straight, usually longer than valva, with or without cornuti.

Male pregenital segments: Intersegmental membrane between 8th abdominal segment and genital organs very long, especially on dorsum, as in *Acrocercops*-species. Eighth segment rather short, with a wide, rectangular cleft on ventrum; dorsal apodeme triangular basally and bar-shaped apically, with its apex reaching nearly cephalic margin of 7th segment. A pair of coremata very long, about as long as 5th to 7th segments combined or slightly shorter, and invaginated from ventrum between 7th and 8th segments. Seventh segment normal in form as in the preceding segments.

Female genitalia: Papilla analis moderate in length, setose as usual; apophysis posterioris moderate in length, narrow, and widened basally. Eighth abdominal segment rather short, bare, widely interrupted on ventrum; apophysis anterioris narrow, usually as long as apophysis posterioris, widened near base. Ostium bursae opened on ventrum of 8th abdominal segment; sclerous lamella postvaginalis absent in type-species or present in the other species. Antrum membranous or partly sclerotized; ductus bursae long, slender, usually lined with microscopic granules on its caudal half; corpus bursae large, pyriform or ellipsoidal, membranous, without any signum.

*Larva.*

Last instar : In 2 species examined, body (Fig. 10) cylindrical, moderately constricted intersegmentally, slightly tapering caudally, with developed thoracic legs and 5 pairs of prolegs, each pair of prolegs situated on 3rd to 6th and 10th abdominal segments ; ventral prolegs with 3-4 minute, vestigial crochets in type-species, or 3-4 well-developed crochets in *A. himalaica* sp. nov., the crochets being arranged in a transverse row ; anal prolegs with no trace of crochets.

Body chaetotaxy (Fig. 11) as follows : — Prothorax with 10 setae on each side, supposed XD2 and L3 being absent ; D1 microscopic, situated nearer to supposed XD1 than to D2, which is longer than XD1 ; SD2 minute, dorsal to SD1 ; L1 and L2 anterior to spiracle, the former about thrice as long as the latter ; SD1, L1 and SV1 about equal in length and the longest of setae on this segment. Mesothorax and metathorax on each side with 8 setae except for proprioceptors ; SD2 anterodorsal to SD1 ; L2 absent ; L3 posterodorsal to L1. On 1st to 8th abdominal segments, D1 anterolateral to D2 ; L2 absent ; L3 ventral to L1 and slightly shorter than the latter ; SV seta group unisetose on 1st, 7th and 8th segments, bisetose on 2nd, and trisetose on prolegs of 3rd to 6th. On 9th segment SD2, L2, L3, SV2 and SV3 absent ; D1 anterolateral to D2 as in the preceding segments. On 8th and 9th segments, proprioceptor MV3 absent as in *Acrocercops*-species.

Larval habit : All the species described here make similar leaf-mines in their larval stages, and pupate on the leaf-surface outside the mines. In early stages, the mine is narrow, linear, interparenchymal, and runs across the leaf from one edge to another twice or thrice, thus the leaf apical to the crossed mines is always discoloured into pale green or yellowish-green ; then the mine enters into the main leaf-vein towards apex, or runs along the main vein ; sometimes it irregularly runs on the space between the edge and the main vein. In late stages, the mine is broadened into a large, blotchy one of the full-depth type within the discoloured area of the leaf. This type of mine seems to be made by the larvae of tissue-feeding form. Finally, a semitransparent, blotchy mine is seen on the discoloured apical area of the leaf. When full grown, the larva becomes ochre-yellowish with a crimson-reddish, broad, transverse band on each segment, and then leaves the mine to pupate through a semicircular slit on the upper surface of the leaf. The cocoon is boat-shaped, with a few bubbles on the surface.

Remarks : The new genus *Artifodina* is very closely related to the genus *Acrocercops*, sharing with the latter many characters in both the adults and larvae as follows : — In the adults, hind tibia has a series of bristly scales above ; the scape of the antenna is smooth without any hairy pecten or scaly tuft ; the male genital valva has a comb on the cucullus ; a pair of coremata is present on the male pregenital segments, etc. In the larvae, the XD seta group on the prothorax is unisetose (supposed XD1 alone present) ; the mesothorax and metathorax lack the seta L2 ; the seta D1 on any abdominal segment is anterolateral to the seta D2, etc. The new genus is, however, separated from *Acrocercops* by the following characters : 1) in fore wing venation the vein  $R_5$  arises from middle of terminal margin of the discoidal cell and is well separated from the vein  $M_1$  ; 2) the 2nd segment of the labial palpus is smooth, without a scaly tuft below ; 3) the vinculum of the male genitalia has a group of deformed setae on cephalic side ; 4) the corpus bursae of the

female genitalia is wholly membranous, without any signum; 5) the last instar larva has 4 pairs of ventral prolegs besides the anal ones; and 6) the SV seta group on the 2nd abdominal segment is bisetose (SV1 and SV2 present) in the last instar larva. In *Acrocercops*, on the other hand, 1) the vein  $R_5$  of the fore wing is usually connate with the vein  $M_1$  basally, and arises from the lower angle of the discoidal cell; 2) the 2nd segment of the labial palpus has a moderately long, scaly tuft beneath, or at least being thickened with scales apically; 3) the vinculum is simple, without any setae; 4) the corpus bursae has 2 signa, each of which is surrounded by many lanceolate sclerites radiating from the centre; 5) the last instar larva has 3 pairs of ventral prolegs; and 6) the SV seta group on the 2nd abdominal segment is trisetose in the last instar larva. Moreover, *Artifodina* is distinguished from *Acrocercops* by the peculiar larval habit as described above. In *Acrocercops*, the larva makes a very large, blister-like, blotchy mine occurring usually on the upper surface of the leaves of food plants (Fletcher, 1920, '33).

It should be emphasized that the genus *Acrocercops* is here understood in the sense of Kuznetzov (1979, '81), because it is still used in a very wide sense, including many heterogenous species, as stated by Vári (1961). Regardless of the limits of *Acrocercops*, however, the present new genus is uniquely characterized by the 4 pairs of ventral prolegs of the last instar larva, and by this character it is distinctly separated not only from *Acrocercops* but also from all the other genera of the family Gracillariidae as discussed under Introduction.

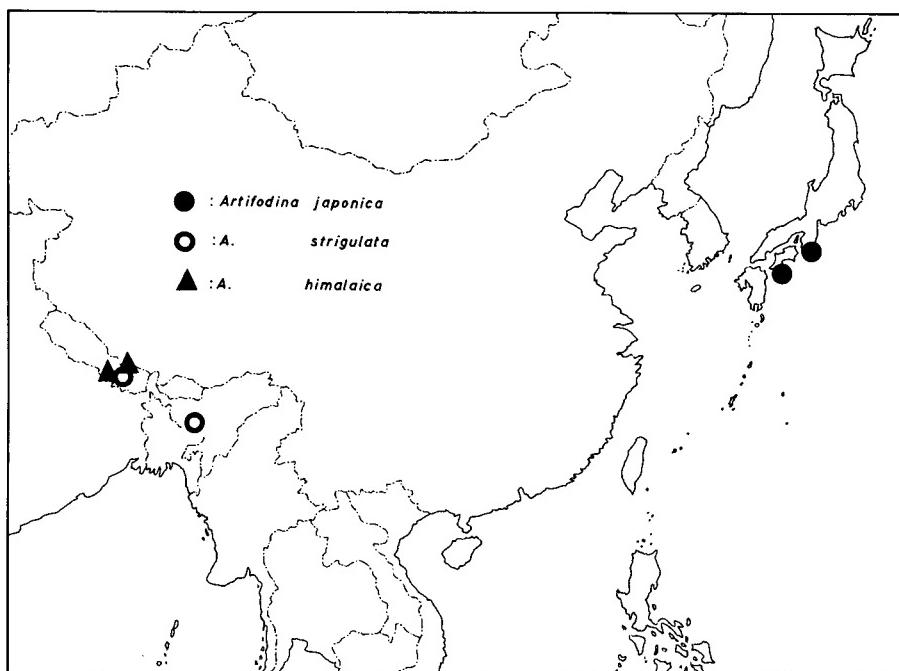


Fig. 1. A distribution map of *Artifodina*-species.

The 3 species of the new genus are all associated with the genus *Myrsine* (Myrsinaceae) in their larval stage, *A. japonica* occurring on *Myrsine seguinii* in

Japan, *A. strigulata* on *M. capitellata* in Northeast India and Nepal, and *A. himalaica* on *M. semiserrata* in Nepal (Fig. 1). This apparent monophagy may suggest that they are differentiated in accord with plant species, otherwise may simply result from their association with locally dominant species of *Myrsine*. According to Good (1969) and Ohwi (1975), *Myrsine* is discontinuously distributed in Africa and the tropical and subtropical Asia, including 4 to 6 species. It is, therefore, interesting to know what species of *Artifodina* are distributed in those areas in association with local species of *Myrsine*.

#### Key to the species

1. Six costal strigulae on fore wing ochre-whitish or whitish, moderately broad, arranged from basal 1/4 to 6/7, and the interspaces of them clouded with grayish or ochre-grayish scales; male valva with a strong projection arising from ventral margin at apical 1/3; male subscaphium triangular, not projected into a hook at cephalic end; female lamella antevaginalis well sclerotized and protruded caudally into a round lobe [food plant: *Myrsine semiserrata*; distribution: Nepal]. ..... *Artifodina himalaica* sp. nov.
- Six costal strigulae on fore wing pure white, narrow, and arranged from basal 1/3 to 7/8 nearly equidistantly; male valva smoothly curved along ventral margin, without a such projection; male subscaphium projected into an acute hook at its cephalic end; female lamella antevaginalis weakly membranous and more or less straight on its caudal margin. ..... 2
2. Male valva with comb of 11-16 teeth which are arranged in a straight line; cornuti of aedeagus absent, when present, 2 or 3 in number, very fine, and twiggy in form; female lamella postvaginalis well developed, bilobed apically [food plant: *Myrsine capitellata*; distribution: Northeast India and Nepal]. ..... *Artifodina strigulata* sp. nov.
- Male valva with comb of 18-21 teeth which are arranged in a curved line; aedeagus with 18-22 minute cornuti; female lamella postvaginalis absent [food plant: *Myrsine seguinii*; distribution: Japan]. ..... *Artifodina japonica* sp. nov.

#### *Artifodina japonica* sp. nov.

[Figs. 3 (A-B), 4 (B-C), 5, 8, 10 (B), 11 (B), 12 (A-D), 13 (A-D), 14 (A-E), and 15 (A-B)]

##### *Adult.*

Specimens examined: 65 ♂♂ & 52 ♀♀. Japan: Honsyū—19 ♂♂ (one the holotype, em. 25. vi. 1964, Gen. sl. no. Grc-1642) & 10 ♀♀, Kii-Ōsima, Wakayama-ken, em. 8-30. vi. 1964, ex *Myrsine seguinii* (breeding no. 681); 33 ♂♂ & 31 ♀♀, ditto, em. 2-28. xi. 1974, ex *M. seguinii* (1337). Sikoku—13 ♂♂ & 11 ♀♀, Asizuri-misaki, Kōti-ken, em. 6-19. xii. 1980, ex *M. seguinii* (2255).

♂♀: Expanse of wings: 7.5-11.0 mm (9.2 mm in holotype, 9.7 mm in average of 20 specimens). Length of fore wing: 3.7-5.5 mm (4.6 mm in holotype, 4.8 mm in average of 20 specimens).

Colour: Head and face covered with white scales, the latter mixed with dark brown scales anteriorly. Palpi white; maxillary palpus infuscated on outer face except for apex; 2nd segment of labial palpus with a longitudinal, dark brown line on outer face. Antenna pale brownish, broadly annulated with dark brown except for apical 10-12 segments which are whitish; scape whitish below, dark brown above. Thorax covered with white scales, with a dark brown, very narrow, longitudinal median line on dorsum; tegula wholly blackish-brown; a blackish-brown patch continued from tegula is placed on pleuron just below base of fore wing. Fore

and mid legs blackish-brown; coxae whitish, with a large, blackish median blotch and a smaller apical blotch on lower face; fore tibia with an antemedian whitish ring, and mid tibia with similar antemedian and postmedian rings; both tarsi with 6 whitish rings. Hind leg dark gray; coxa whitish basally and apically; femur broadly whitish medianly; tibia becoming paler basally, with spurs white except for their subapical area; tarsus brownish-black, with 6 whitish rings at nearly equal intervals. Abdomen dark brownish-gray dorsally, whitish ventrally, with a series of grayish streaks oblique on lateral faces, the streaks from both sides being connected at ventrum; ♂ with a pair of coremata of fine, long, silky-white hairs, which are sometimes spread out well beyond apex of abdomen.

Fore wing brownish-black, tinged with purplish reflections, with white markings; a longitudinal stripe extending along dorsal margin throughout, occupying about 1/4 breadth of wing on its basal 3/5, then abruptly widened and occupying about half breadth of wing on its apical 2/5, usually interrupted by ochre-brown or ochre-gray at tornus and centre of termen; 6 narrow strigulae arranged on costa from basal 1/3 to 7/8 of wing, the 1st being strongly oblique outwardly, reaching about 1/3 across wing and somewhat obscure in its margins, the 2nd to 4th nearly parallel to each other, less oblique and shorter than the 1st, but reaching nearly half across wing, the 5th and 6th very short; a narrow transverse fascia placed near apex of wing, separated from the last costal strigula by a narrow line of ground colour, arched inwardly, followed by a pyriform apical space of ground colour; an apical spot minute and crescent-shaped; cilia around apex of wing blackish-brown with a white, rather broad median band, those along termen and dorsal margin dark ochreous-brown, and mixed with short white hairs. Hind wing blackish-brown, somewhat paler basally; cilia dark ochreous-brown or dark grayish-brown.

Male genitalia (Fig. 5): Tegumen rather long, widely rounded apically in ventral view, with a pair of subapical setae; lateral faces moderately sclerotized on basal 3/5, with a few short, oblique wrinkles, and with 2 or 3 fine setae; subscaphium strongly sclerotized, widened in middle, then narrowed basally into an acute hook. Valva about 1.2 times as long as tegumen, somewhat wing-shaped, slightly bent upwardly at apical 2/5, widest in middle, rounded apically; comb with 18-21 teeth which are arranged in a curved line from basal 3/5 to 4/5 of valva; fine setae occurring rather densely around apex and ventral area of inner face; very long androconial scales scattered on basal 3/5 of outer face; transtilla complete, narrow. Vinculum with 30-35 minute, comma-shaped setae on cephalic side; saccus slender, about 3/5 as long as valva. Aedeagus tubular, straight, about 1.3 times as long as valva, pointed apically, with 18-22 minute cornuti arranged in a row from apical 3/5 to apex; ductus ejaculatorius about 2/3 as long as aedeagus. Eighth abdominal segment with a rectangular concavity on ventrum, the concavity being widened cephalad; a dorsomedian apodeme reaching cephalic margin of 7th abdominal segment, truncated apically. A pair of coremata of long hairs about as long as 5th to 7th abdominal segments combined. (Five slides examined.)

Female genitalia (Fig. 8): Papilla analis moderate in length, subtriangular in lateral view; apophysis posterioris slender, straight, widened at base into a rectangle. Eighth abdominal segment rather short, its sclerotized part narrowed ventrally, widely interrupted on ventrum, and transversely wrinkled or carinated; apophysis anterioris about as long as apophysis posterioris, widened basally. Ventrocaudal

margin of ostium bursae straight; lamella postvaginalis absent. Antrum widened towards ostium bursae, irregularly and densely wrinkled; ductus bursae slender, slightly widened caudally, lined with dense microscopic scobinations from cephalic end of antrum to middle of ductus bursae; corpus bursae weakly membranous, elongate-pyriform or ellipsoidal, without signa. (Five slides examined).

*Larva.*

Specimens examined: Ten larvae and 35 exuviated head-capsules. Five larvae of last instar, 6 heads of tissue-feeding form and 18 heads of sap-feeding form, Nati, Wakayama-ken, Honsyû, 18. x. 1966, ex *Myrsine seguinii* (836); 5 larvae of last instar, 3 heads of tissue-feeding form and 8 heads of sap-feeding form, Kii-Ôsima, Wakayama-ken, 24. ix. 1974, ex *M. seguinii* (1337). All mounted on slides except for 1 larva in alcohol.

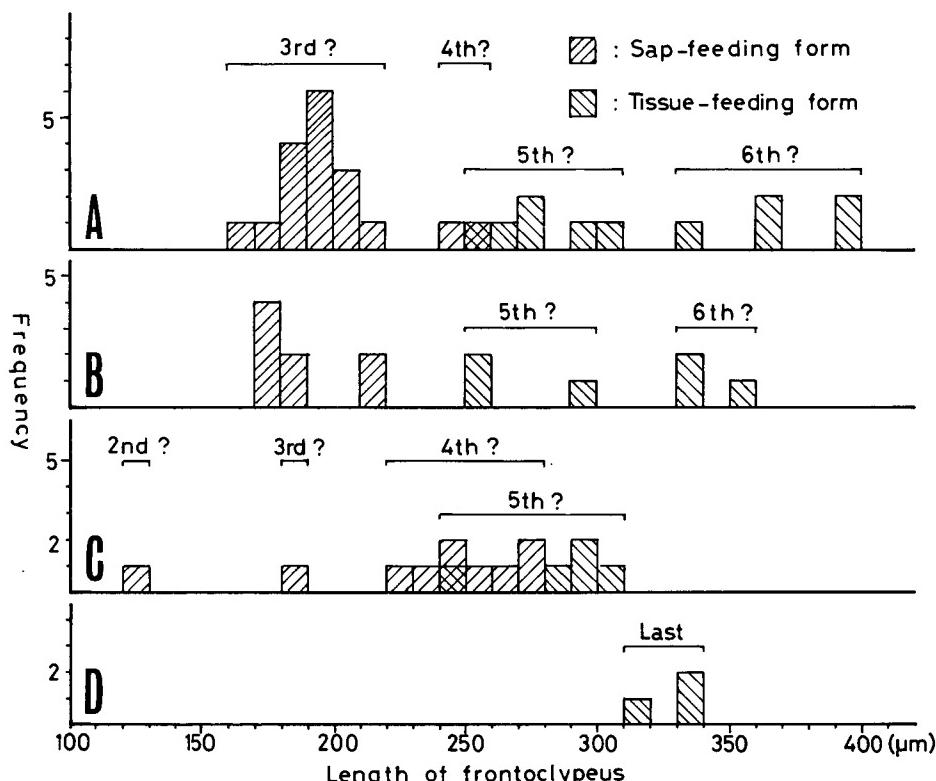


Fig. 2. Frequency of length of larval frontoclypeus in *Artifodina*-species. A: *A. japonica* sp. nov. [Nati, Wakayama-ken, Japan]—B: ditto [Kii-Ôsima, Wakayama-ken]—C: *A. strigulata* sp. nov. [Cherrapunjee, Meghalaya, India]—D: *A. himalaica* sp. nov. [Simigaon, Janakpur, Nepal].

Number of instars: The larval head-capsules, available from several leaf-mines, are divided into 2 forms, the sap-feeding form of early instars and the tissue-feeding form of the later instars. However, I have failed to decide the number of larval instars on the basis of the length of the frontoclypeus (Fig. 2). On the other hand, I found from a single leaf-mine (breeding number 836) 4 head-capsules

of sap-feeding form. The sap-feeding form should, therefore, pass through at least 4 instars in this species. The tissue-feeding form definitely occurs in the last 2 instars.

Supposed 6th (last) instar : Head (Fig. 12, A) round as usual, nearly orthognathous, with posterodorsal prolongations moderately long ; frontoclypeus opened, elongate-oblong, slightly narrowed posteriorly ; adfrontal suture very weak. Cranial seta A2 far anterior to level of setae A3 and about same level with setae F1 ; SO2 and O2 the longest among cranial setae and followed by A1 and O1 ; seta P1 moderate in length, and about as long as A2 and L1 ; supposed seta P2 located near setae X. Ocelli (Fig. 13, B) 5 on each side (6th absent), divided into 2 groups, the posterior group consisting of 1st and 2nd ocelli, and the anterior of 3rd to 5th, all nearly same in size ; ocellar seta O1 nearer to 3rd ocellus than to 2nd. Antenna (Fig. 13, D) 3-segmented, with sensilla as usual in most lepidopterous larvae ; a sensillum styloconicum on 3rd segment 2-segmented, about as long as a sensillum basiconicum on that segment. Labrum (Fig. 12, C) about half as long as wide, shallowly and roundly emarginate medianly, the lateral lobes round ; 2 lateral and 2 median labral setae on each side (supposed L3 and M3 absent) ; 3 moderately large epipharyngeal setae on ventral face of each side ; epipharyngeal shield subtriangular, much widened apically. Mandible (Fig. 13, C) with 6 teeth, the 1st tooth small and situated rather on inner face, the 3rd longest. Labiomaxillary complex (Fig. 12, B) similar to that of most lepidopterous larvae in structure ; spinneret well developed, elongate-oblong, about 2.5 times as long as middle segment of labial palpus ; maxillary stipes weakly sclerotized on almost whole area, without any spinules.

Body (Fig. 10, B) creamy-whitish, then changed into ochre-yellowish with a wide, transverse, crimson-reddish band on each segment when full grown ; cylindrical, slightly tapering posteriorly. Thoracic legs rather small, the fore leg about 2/3 as large as mid and hind legs ; tarsi, tibiae, femora and coxae with 4, 4, 0 and 6 setae, respectively ; claw rather slender, simple, without inner tooth. Ventral prolegs (Fig. 13, A) located on 3rd to 6th abdominal segments, without crochets completely or with 2 or 3 crochets in some specimens but much reduced in size ; anal proleg without crochet. Spinules of body surface minute, pointed, dense, and much smaller around spiracular line. Chaetotaxy of body as shown in Fig. 11, B and described under the genus.

Supposed 5th instar : Only exuviated head-capsules examined. Not essentially different from last instar except for following points : — Spinneret (Fig. 12, D) obovate in outline, a little longer than wide ; labial palpus short, the middle segment about 2 times as long as wide ; postmentum without any spinules on area anterior to postmental setae ; maxillary galea with 3 sensilla styloconica very long.

Supposed 4th instar (last instar of sap-feeding form) : Only exuviated head-capsules examined. Head (Fig. 14, A) flattened dorsoventrally, wedge-shaped, prognathous, with posterodorsal prolongations well developed ; a pair of sclerotized ridges originated from anterior ends of frontal sutures, divergent posteriorly, but not touched to posterior margin of cranium ; lateral ridges well sclerotized. Cranial seta A1, A3, O1, O2 and SO2 prominent, the other setae minute and sometimes visible in their basal sockets alone. Frontoclypeus elongate-oblong, nearly parallel-sided. Ocelli not visible in exuviated head-capsules examined. Antenna (Fig. 14, E) similar to that of tissue-feeding form in structure, but 2nd segment shortened. Labrum (Fig.

14, D) trapezoid, much widened apically, notched medianly, the lateral lobes widely round and covered with dense, fine hairs around mesal margins throughout; labral setae and epipharyngeal setae absent. Mandible (Fig. 14, C) flattened, subcircular in outline, 3-toothed, the 3rd tooth with 3 or 4 crenulations on its apex. Labiomaxillary complex (Fig. 14, B) very simple, flattened dorsoventrally, without any distinct setae; prementum very widened, with lateral part protruded well beyond maxillary part; spinneret absent; postmentum about 4 times as long as prementum, widened posteriorly; hypopharynx protruded beyond labium, bilobed apically, covered with dense, fine hairs; maxillary palpifer much reduced in size, with 2 conical projections at apex (inner projection supposed to be galea and the outer one palpus); stipes narrow, simple, with a single short seta.

Supposed 3rd instar: Only exuviated head-capsules examined, and not different from supposed 4th instar described above except for size.

Supposed 2nd and 1st instars: Unknown.

Leaf-mine: As described under the genus and as shown in Fig. 15, A-C.

Food plant: *Myrsine seguinii* Lév. (Myrsinaceae).

Distribution: Japan (Honshū; Sikoku).

*Artifodina strigulata* sp. nov.

[Figs. 3 (C-D), 4 (D), 6, 9 (A-B), 12 (E-F), 13 (E-F), 14 (F-J), and 16 (A-B)]

Adult.

Specimens examined: 22 ♂♂ & 15 ♀♀. India: 1 ♂ & 5 ♀♀, Mausmai Cave, nr. Cherrapunjee, Meghalaya, em. 18-30. iii. 1978, ex *Myrsine capitellata* (breeding no. Ind-85). Nepal: 18 ♂♂ (one the holotype, em. 17. x. 1983, Gen. sl. no. Grc-3174) & 18 ♀♀, Mulkharka (alt. 2000 m), Kathmandu Valley, Bagmati, em. 6-26. x. 1983, ex *M. capitellata* (Npl-574); 1 ♂ & 1 ♀, ditto, em. 24-28. x. 1983, ex ? *M. semiserrata* (Npl-571); 2 ♂♂, Godawari (alt. 1500 m), Kathmandu Valley, em. 3-10. viii. 1983, ex *M. capitellata* (Npl-180); 1 ♀, ditto, em. 17. x. 1983, ex *M. capitellata* (Npl-548).

♂♀: Expanse of wings: 8.2-11.5 mm (9.0 mm in holotype, 9.7 mm in average of 20 specimens). Length of fore wing: 4.0-5.6 mm (4.4 mm in holotype, 4.8 mm in average of 20 specimens).

Colour: Colour pattern of this species is very similar to that of the preceding *A. japonica*, and I have failed to separate them clearly by this feature. However, *A. strigulata* may be separated from *A. japonica* by the following characters: ground colour of fore wing more deeply blackish than that of *A. japonica*; a pyriform apical space between preapical white fascia and apical white spot purely jet black; 6 white costal strigulae sometimes irregularly interrupted by ground colour, with interspaces between these strigulae indistinctly spotted with grayish-ochreous scales on costa in a few specimens.

Male genitalia (Fig. 6): Tegumen with a pair of strongly sclerotized, crescent-shaped lobes on ventral face in middle; basal hook of subscaphium longer than that of *A. japonica*. Valva similar to that of *A. japonica* in form, but a little slenderer; comb with 11-16 teeth which are arranged in a straight line from basal 3/5 to 4/5 of the valva. Vinculum with 25-35 minute, pyriform setae on cephalic side; saccus about 2/5 as long as valva. Aedoeagus usually without cornuti, but in some speci-

mens collected from Nepal, including holotype, 2 or 3 very fine twiggy cornuti present near apex (Fig. 6, D). Dorsomedian apodeme of 8th abdominal segment round apically. The other characters are quite similar to those of *A. japonica*. (Seven slides examined.)

Female genitalia (Fig. 9, A & B) : Papilla analis a little longer than that of *A. japonica*, oblong in lateral view ; apophysis posterioris slender, widened into a rectangle at base. Eighth abdominal segment also a little longer than that of *A. japonica*, its sclerotized part widely interrupted on ventrum, with many irregular wrinkles likewise ; apophysis anterioris straight, widened towards base, a little thicker and shorter than apophysis posterioris. A well-sclerotized ventral flap or lamella postvaginalis situated between papilla analis and 8th abdominal segment, bilobed apically ; ventrocaudal margin of ostium bursae nearly straight. Antrum, ductus bursae and corpus bursae weakly membranous, with an elongate patch of scobinations lying on ductus bursae between the caudal 1/5 and 1/2 or 2/3 ; corpus bursae elongate-pyriform or ellipsoidal, without signa. (Four slides examined.)

#### *Larva.*

Specimens examined : Five heads of tissue-feeding form and 10 heads of sap-feeding form, Mausmai Cave, nr. Cherrapunjee, Meghalaya, India, 11. ii. 1978, ex *Myrsine capitellata* (Ind-85). All mounted on slides.

Number of instars : Not certainly defined. Judging from the length of the frontoclypeus of the exuviated head-capsules available from several mines, however, this species seems to pass through at least 6 instars in the larval stage like the preceding *A. japonica*. It has 2 larval forms likewise.

Supposed 6th (last) instar : I have found no material corresponding in structure to the last instar of *A. japonica*.

Supposed 5th instar (first instar of tissue-feeding form) : Only exuviated head-capsules examined. The characters which can be observed are very similar to those of the supposed 5th instar of *A. japonica*. Head round, nearly orthognathous, with posterodorsal prolongations triangular ; frontoclypeus opened, elongate-oblong, about 2 times as long as wide, narrowed posteriorly on its posterior half ; adfrontal suture not visible. Cranial seta A2 nearer to A1 than to A3 ; A1 longest among cranial setae and followed by O2, SO2, O1 and A1. Ocelli similar to those of last instar larva of *A. japonica* in arrangement. Antenna (Fig. 13, F) 3-segmented, with sensilla as usual in most lepidopterous larvae. Labrum (Fig. 12, F) about 1/2 as long as wide, emarginate medially, the lateral lobes round apically and covered with epipharyngeal hairs on inner face and along apical margins ; epipharyngeal shield jar-shaped, widened apically, obtusely round basally ; 2 lateral setae, 2 median ones and 3 epipharyngeal ones present on each side as in *A. japonica*. Mandible (Fig. 13, E) with 6 teeth. Labium (Fig. 12, E) with spinneret obovate in outline, nearly as long as wide.

Supposed 4th instar (last instar of sap feeding form) : So far as the exuviated head capsules are examined, this instar is also essentially as in *A. japonica* except for the following points : — Mandible (Fig. 14, G) comparatively slender. Lateral margins of labrum (Fig. 14, H & I) less divergent than those of *A. japonica*. Mesal projection (supposed galea) of maxillary palpifer (Fig. 14, F) bifurcated apically.

Supposed 3rd and 2nd instars : Exuviated head-capsules examined are not different from those of corresponding instars of *A. japonica* and also from those of

the 4th instar of *A. strigulata*.

Supposed 1st instar: Not examined.

Leaf-mine: As described under the genus and as shown in Fig. 16, A & B.

Food plant: *Myrsine capitellata* Wallich and (?) *M. semiserrata* Wallich (Myrsinaceae). The record from *M. semiserrata* may possibly be based on erroneous identification of the host plant, because all the other specimens reared from *M. semiserrata* belong to the next species.

Distribution: India (Meghalaya); Nepal (Bagmati).

*Artifodina himalaica* sp. nov.

[Figs. 3 (E-F), 4 (E), 7, 9 (C), 10 (C-D), 12 (G-H), 13 (G-J), 15 (D), and 16 (C-D)]

Adult.

Specimens examined: 14 ♂♂ & 19 ♀♀. Nepal: 2 ♂♂ & 5 ♀♀, Balaju (alt. 1400 m), Kathmandu Valley, Bagmati, em. 31. v-14. vi. 1968, ex *Myrsine semiserrata* (breeding no. Npl-20); 2 ♂♂ & 2 ♀♀, ditto, em. 28. x-4. xi. 1983, ex *M. semiserrata* (Npl-671); 3 ♂♂ (one the holotype, em. 21. viii. 1983, Gen. sl. no. Grc-3094) & 2 ♀♀, Godawari (alt. 1500 m), Kathmandu Valley, em. 12-28. viii. 1983, ex *M. semiserrata* (Npl-181); 1 ♂, ditto, em. 14. viii. 1983, ex *M. semiserrata* (Npl-182); 5 ♂♂ & 7 ♀♀, ditto, em. 20-26. x. 1983, ex *M. semiserrata* (Npl-482); 1 ♀, Mulkharka (alt. 2000 m), Kathmandu Valley, em. 27. x. 1983, ex *M. semiserrata* (Npl-571); 1 ♂ & 1 ♀, Siwapuri (alt. 2000-25000 m), Kathmandu Valley, em. 23-28. viii. 1983, ex *M. semiserrata* (Npl-219); 1 ♀, Simigaon (alt. 2000 m), Rolwaling Valley, Janakpur, em. 26. ix. 1983, ex *M. semiserrata* (Npl-331).

♂ ♀: Expanse of wings: 7.0-11.0 mm (10.5 mm in holotype, 9.4 mm in average of 20 specimens). Length of fore wing: 3.4-5.5 mm (5.2 mm in holotype, 4.5 mm in average of 20 specimens).

Colour: Head ochre-whitish; face whitish, mixed with a few dark gray scales anteriorly and laterally. Palpi white; maxillary palpus infuscated on outer face; 2nd segment of labial palpus lined with blackish brown on outer face. Antenna ochre-whitish, faintly annulated with brown except for apical 10-12 segments; scape ochre-brownish above; ochre-whitish below. Thorax white to ochre-whitish, with a very narrow, dark brownish, longitudinal median line on dorsum; tegula wholly blackish-brown; a blackish-brown patch placed on mesopleuron just below base of fore wing, and detached from tegula. Fore and mid legs brownish-black; coxae with a basal white patch and a subapical white one on lower faces; tibiae with a rather broad, white subbasal ring; tarsi with 6 white rings equidistantly, the white rings being usually broader than the blackish parts. Hind leg ochre-whitish; coxa with a brownish-black median patch on outer face; femur blackish at base narrowly; tibia becoming dark gray apically, with spurs narrowly blackish at their subapical parts; tarsus with 5 blackish rings arranged equidistantly and narrower than whitish parts. Abdomen grayish-ochreous on dorsum, ochre-whitish on ventrum, with series of rather broad, gray, oblique streaks on lateral faces, the streaks from both sides connected in middle of ventrum; anal scales ochre-yellow; ♂ with a pair of coremata of white, long hairs sometimes spread out.

Fore wing dark brownish-gray, much darkened on costal area near base and in disc from base to basal 1/3 of wing, with ochre-whitish or whitish markings; a

longitudinal stripe extending along dorsal margin below wing-fold from base to tornus, its basal 1/5 being slightly narrowed, its apical 1/5 broadened, and its upper margin sinuate and mixed with ochre-gray scales throughout ; 2 or 3 white patches situated on tornus and termen, sometimes confluent to each other through wing-margin ; narrow interspaces between these patches discoloured into pale gray or ochre-gray ; 6 moderately broad strigulae arranged nearly equidistantly on costa from basal 1/4 to 6/7 of wing, all oblique outwardly, becoming pure white and broadened towards costa of wing, the first 3 extending nearly half breadth of wing, parallel to each other and pointing towards apex of wing, the 4th less oblique than the precedings and extending nearly to 1st patch on termen, the 6th rather perpendicular and about as long as the 5th ; interspaces between these strigulae widely clouded with grayish or ochre-grayish scales ; in a few specimens these clouded patches irregularly confluent with the strigulae to form a large costal blotch intermixed with white, gray, ochre-gray and blackish scales ; a white fascia placed just before apex of wing, narrow and arched inwardly ; a blackish subapical blotch pyriform, narrowly edged with grayish white inwardly, and followed by a whitish, crescent-shaped apical spot, which is situated on costal side of apex ; cilia around apex of wing blackish, with a moderately broad and white median band, those along termen whitish with 2 or 3 grayish dashes, and those along dorsal margin wholly pale gray. Hind wing gray ; cilia pale gray.

Male genitalia (Fig. 7) : Tegumen slightly constricted at basal 1/3 and rather sharply narrowed apically in ventral view, with 1 or 2 pairs of subapical setae ; lateral faces moderately sclerotized, with a pair of mesal edges divergent apically, and with 4 to 5 fine setae in middle ; subscaphium sclerotized merely on basal area of tuba analis, triangular. Valva about 1.3 times as long as tegumen, widely wing-shaped, slightly bent upwardly in middle, with a strong projection arising from ventral margin at apical 1/3 of valva, the projection being widened basally, and about 2/3 as long as comb ; comb with 20-26 teeth arranged in a sigmoid line from basal 2/7 to 4/7 of valva ; many fine setae covered rather densely on apical area and sparsely on ventral area of inner face ; very long androconial scales scattered on basal half of outer face. Vinculum with 20-35 minute pyriform or spindle-shaped setae on cephalic side ; saccus slender, about half as long as valva. Aedoeagus tubular, straight, about 1.5 times as long as valva, with 15-17 minute cornuti arranged in a row ; ductus ejaculatorius about 1.3 times as long as aedoeagus. Eighth abdominal segment short and wide, with a rectangular ventral concavity shallow and wide ; a pair of coremata of long hairs a little shorter than length of 6th and 7th abdominal segments combined. Seventh abdominal segment with 2 or 3 rows of long scales along caudal margin of sternite besides normal body scales, these scales having larger basal sockets. (Four slides examined.)

Female genitalia (Fig. 9, C) : Papilla analis short, subtriangular in lateral view ; apophysis posterioris straight, slender, very slightly widened on its basal 2/5. Eighth abdominal segment rather long, with sclerotized area widely interrupted on ventrum and covered with microscopic spines on cephalic area ; apophysis anterioris straight, slender, about 1/2 to 2/3 as long as apophysis posterioris. A well-sclerotized ventral flap or lamella postvaginalis trapezoid, straight on caudal margin ; ventrocaudal margin of ostium bursae or lamella antevaginalis well sclerotized and protruded caudally into a round lobe. Antrum partially well sclerotized,

densely lined with minute granular spines ; ductus bursae narrow, long, lined with dense scobinations on caudal half; corpus bursae membranous, rather small, globular or pyriform, without signa. (Five slides examined.)

*Larva.*

Specimens examined: Five larvae. Three larvae of last instar (mounted on slide), Simigaon (alt. 2000 m), Rolwaling Valley, Janakpur, Nepal, 13. viii. 1983, ex *Myrsine semiserrata* (Npl-331) ; 2 larvae of last instar (in alcohol), Siwapuri (alt. 1500 -2000 m), Kathmandu Valley, Bagmati, Nepal, 18-20. vii. 1983, ex *M. semiserrata* (Npl-219).

Number of instars: Unknown ; only the last instar larvae are examined.

Last instar: Cranial seta P3 located near lateral ridge of head ; A3 longest among cranial setae and followed by O2 and SO2. Labrum (Fig. 12, G) with epipharyngeal shield jar-shaped, round basally. Labium (Fig. 12, H) with spinneret very long, about 3 times as long as middle segment of labial palpus ; posterior extremity of postmentum sparsely covered with spinules on membranous part. Maxillary stipes (Fig. 12, H) also sparsely covered with spinules on membranous part of its posterior extremity. Body (Fig. 10, C & D) cylindrical, tapering slightly anteriorly and moderately posteriorly. Fore leg about 3/4 as large as mid and hind legs ; tarsi, tibiae, femora and coxae with 4, 4, 0 and 5 setae, respectively. Ventral prolegs (Fig. 13, H) located on 3rd to 6th abdominal segments, with 3 to 7 well-developed uniorbital crochets arranged in a transverse row. Ninth abdominal segment with 5 tactile setae (seta SV1 absent). The other features are not obviously different from those of the last instar larva of *A. japonica*.

Leaf-mine: Not obviously different from description given under the genus, and shown in Figs. 15, D, and 16, C & D.

Food plant: *Myrsine semiserrata* Wallich (Myrsinaceae).

Distribution: Nepal (Bagmati ; Janakpur).

#### ACKNOWLEDGEMENTS

First of all I wish to express my thanks to the authorities of the Indian Government and His Majesty's Government of Nepal for their permission and support for the project "Research Trips for Agricultural and Forest Insects in the Subcontinent of India". I also wish to express my cordial thanks to the late Prof. Dr. D.N. Raychaudhuri of the University of Calcutta and Prof. Dr. T.N. Ananthakrishnan of Loyolla College at Madras, Indian promoters of the project in 1978, and to Dr. K.C. Sharma of the Department of Agriculture of the Nepalese Government at Kathmandu and Prof. Dr. K.M. Pradhan of Tribhuvan University at Kathmandu, Nepalese promoters of the project in 1983.

I also make grateful acknowledgements to the following members of the project for their kindly helping me in various ways during my trips : Dr. R.K. Varshney and Dr. G.S. Arora, both of the Zoological Survey of India at Calcutta ; Dr. M.R. Gosh of the University of Kalyani ; Dr. D. Raychaudhuri and Dr. P.K. Mandal, both of the University of Calcutta ; Dr. V.K. Thapa of Tribhuvan University at Kathmandu ; Mr. N.R. Sharma and Mr. J. Kumar K.C., both of the Department of Agriculture of the Nepalese Government at Kathmandu.

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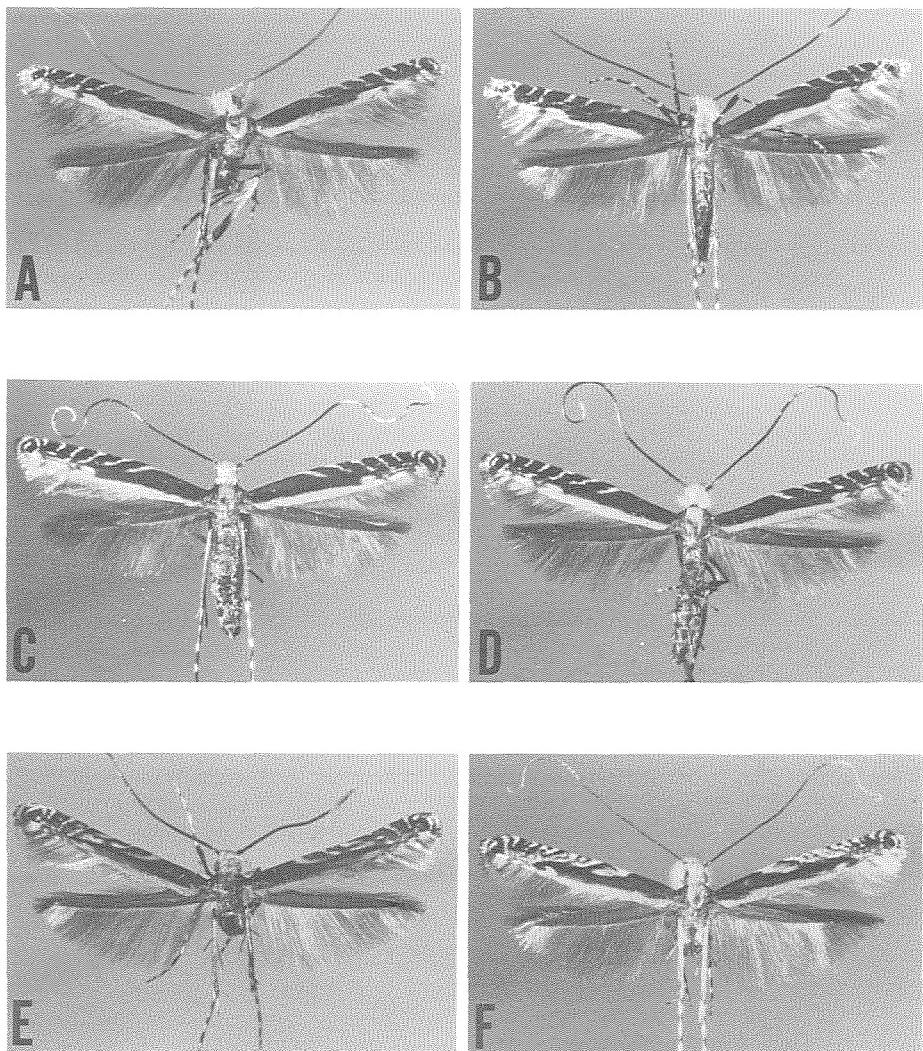


Fig. 3. Adult specimens. A : *Artifodina japonica* sp. nov. (♂, holotype)—B : Ditto (♀) [Kii-Ōshima, Wakayama-ken, Japan, ex *Myrsine seguinii*]—C : *Artifodina strigulata* sp. nov. (♀) [Mulkharka, Bagmati, Nepal, ex *Myrsine capitellata*]—D : Ditto (♀) [Ditto]—E : *Artifodina himalaica* sp. nov. (♂, holotype)—F : Ditto (♀) [Godawari, Bagmati, Nepal, ex *Myrsine semiserrata*].

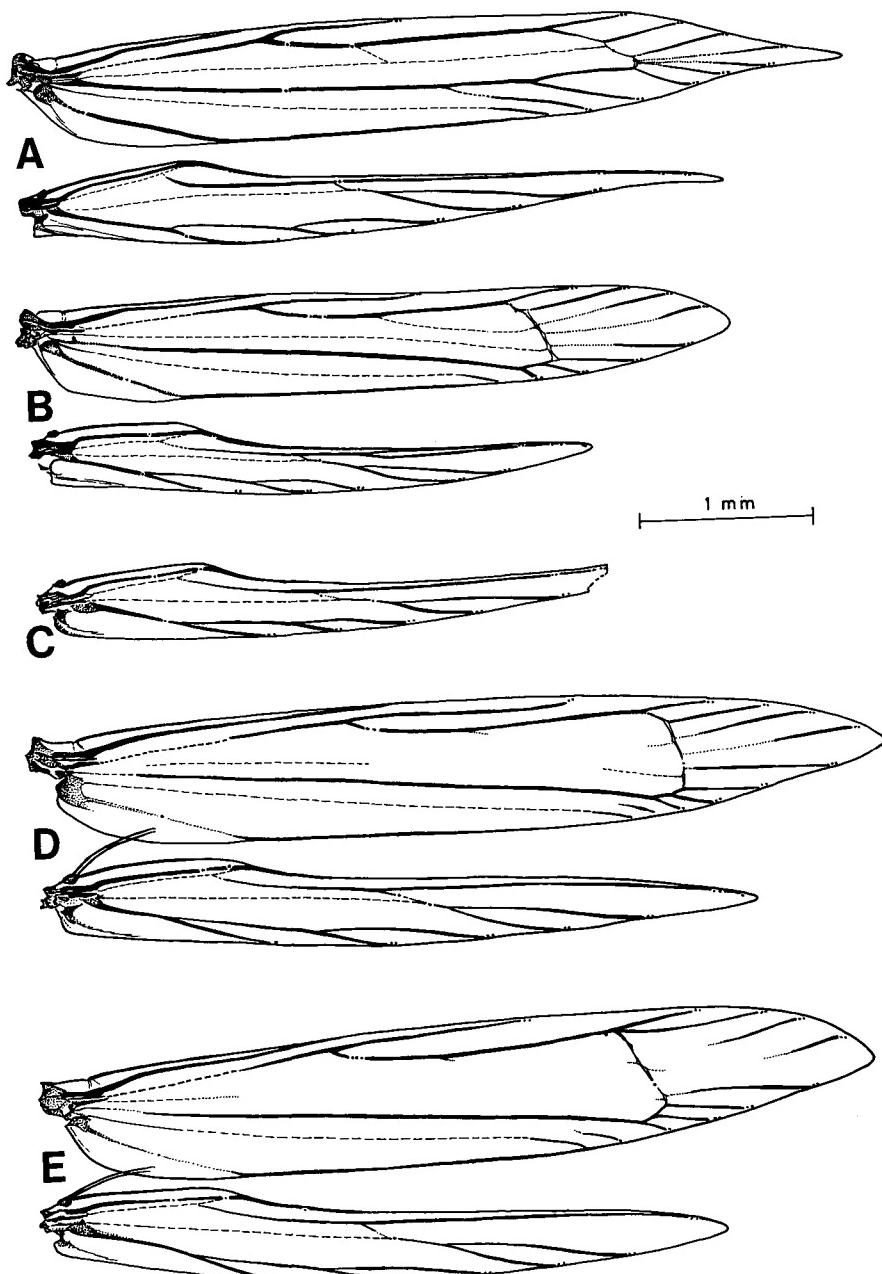


Fig. 4. Wing venation. A: Fore and hind wings of *Acrocercops brongniardella* (Fabricius) [Berlin, Germany, ex *Quercus robur*, Sl. no. Grc-576]—B: Fore and hind wings of *Artifodina japonica* sp. nov. [Kii-Ōsima, Wakayama-ken, Japan, ex *Myrsine seguinii*, Sl. no. Grc-1643]—C: Hind wing of *Artifodina japonica* sp. nov. [Kii-Ōsima, Wakayama-ken, Japan, Sl. no. Grc-1116]—D: Fore and hind wings of *Artifodina strigulata* sp. nov. [Cherrapunjee, Meghalaya, India, Sl. no. Grc-2304]—E: Fore and hind wings of *Artifodina himalaica* sp. nov. [Balaju, Bagmati, Nepal, Sl. no. Grc-1665].

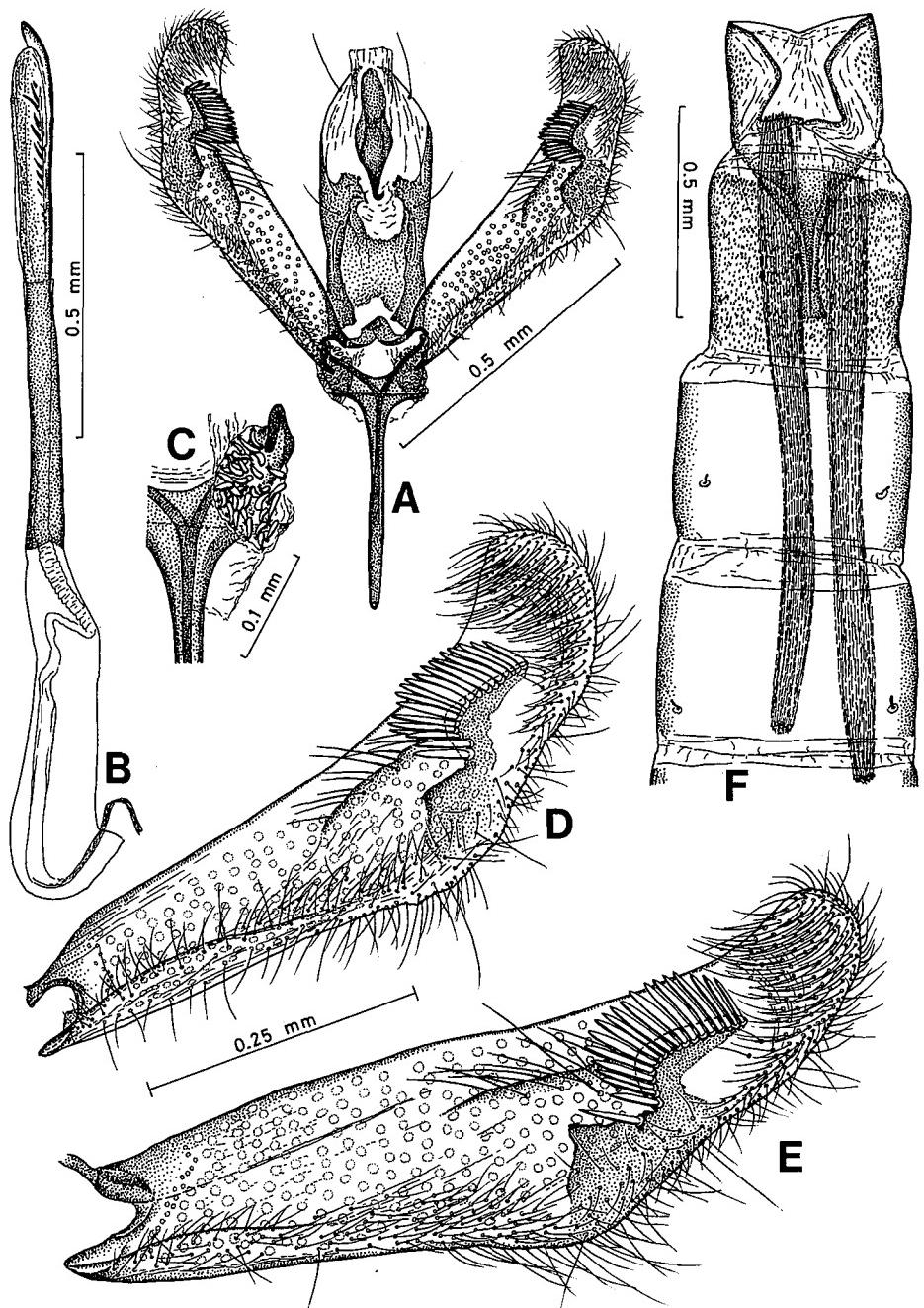


Fig. 5. Male genitalia of *Artifodina japonica* sp. nov. A: Ventral view, aedeagus omitted (holotype)—B: Aedeagus (holotype)—C: A part of vinculum (holotype)—D: Right valva (holotype)—E: Ditto [Asizuri-misaki, Kōti-ken, Japan, Sl. no. Grc-3031]—F: Fifth to 8th abdominal segments in ventral view (holotype).

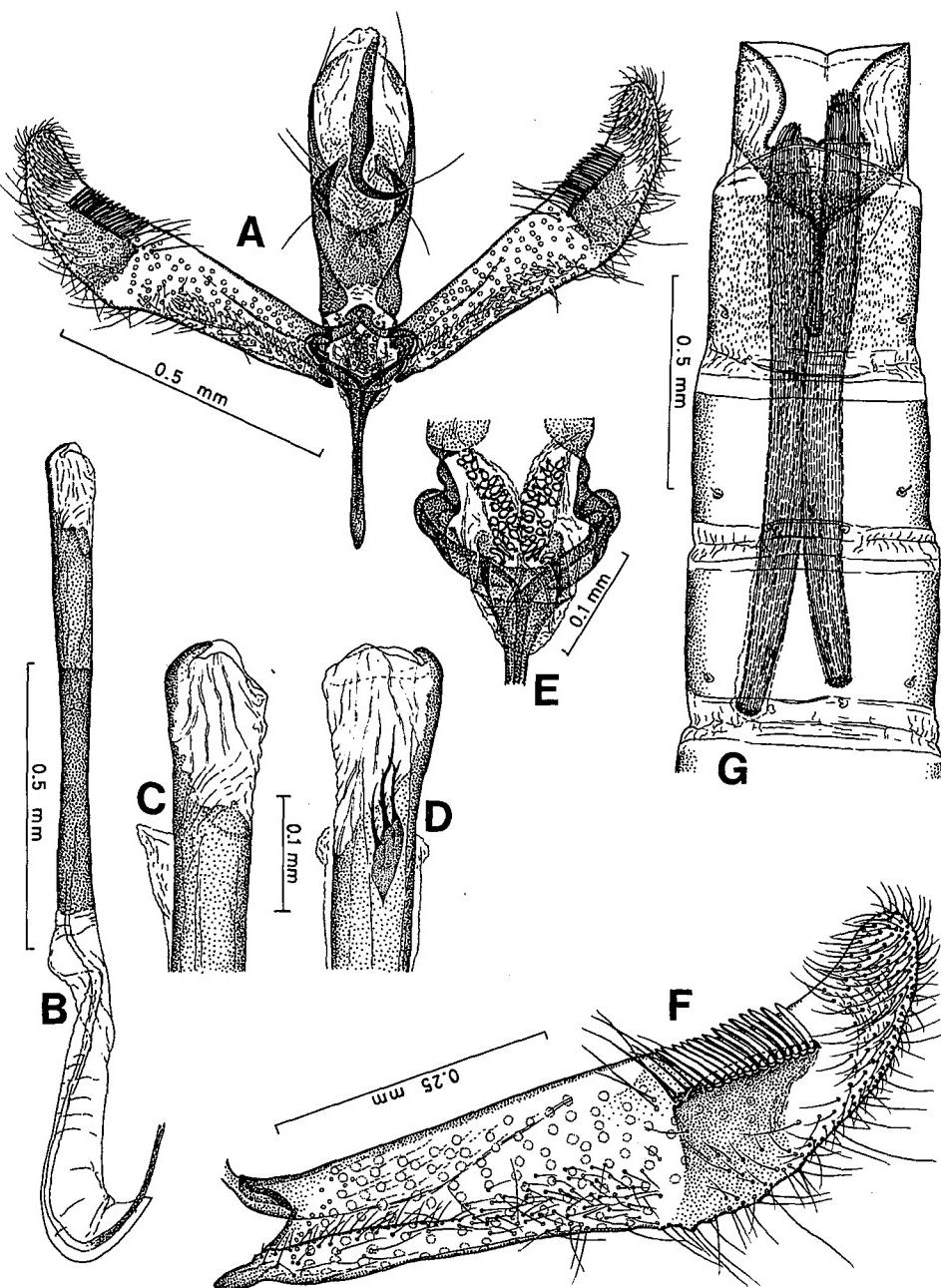


Fig. 6. Male genitalia of *Artifodina strigulata* sp. nov. A: Ventral view, aedeagus omitted [Cherrapunjee, Meghalaya, India, Sl. no. Grc-2276]—B: Aedeagus [Ditto]—C: Apical part of aedeagus enlarged [Ditto]—D: Ditto [Mulkharka, Bagmati, Nepal, Sl. no. Grc-3175]—E: Basal part of vinculum [Sl. no. Grc-2276]—F: Right valva [Ditto]—G: Fifth to 8th abdominal segments in ventral view [Ditto].

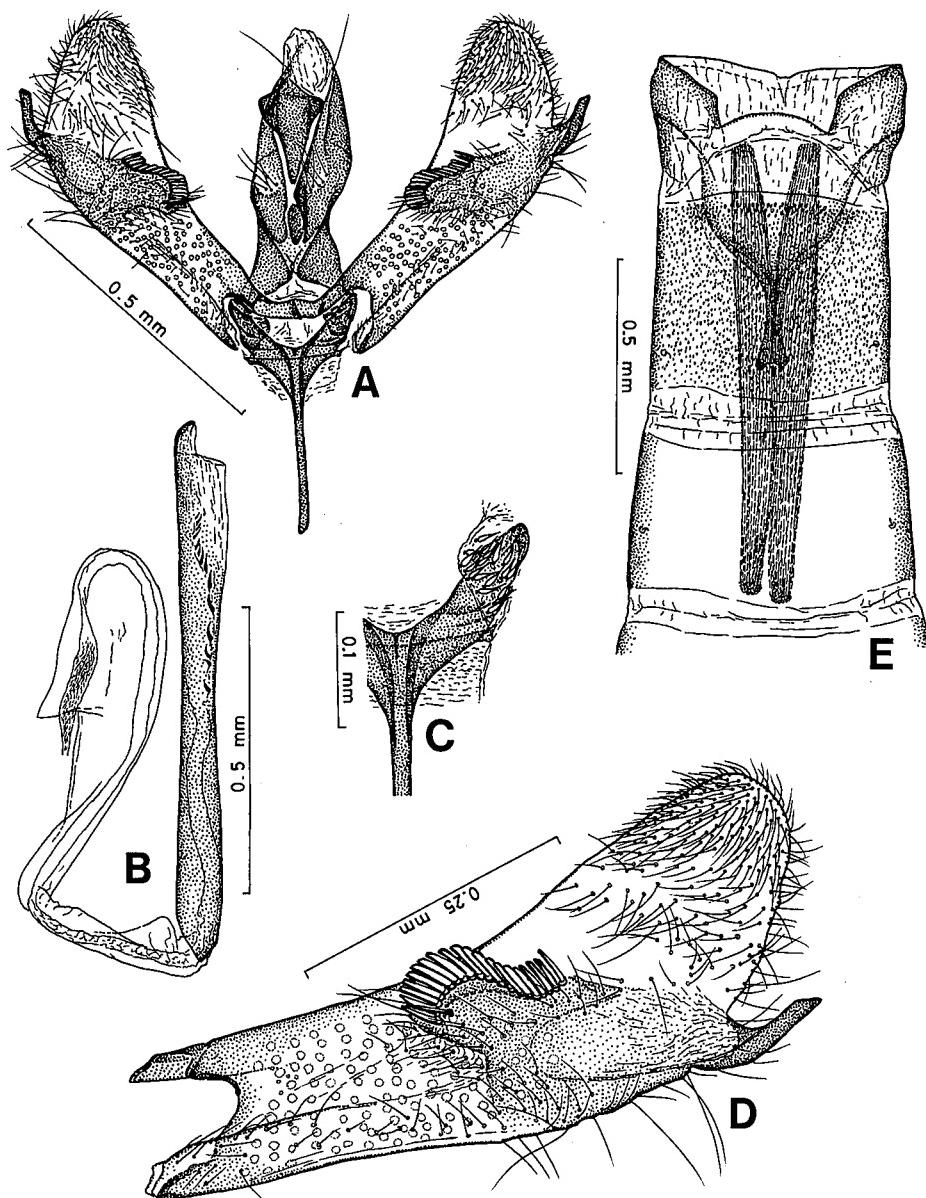


Fig. 7. Male genitalia of *Artifodina himalaica* sp. nov. A: Ventral view, aedeagus omitted [Balaju, Bagmati, Nepal, Sl. no. Grc-1478]—B: Aedoeagus [Ditto]—C: A part of vinculum [Ditto]—D: Right valva [Ditto]—E: Sixth to 8th abdominal segments in ventral view [Ditto].

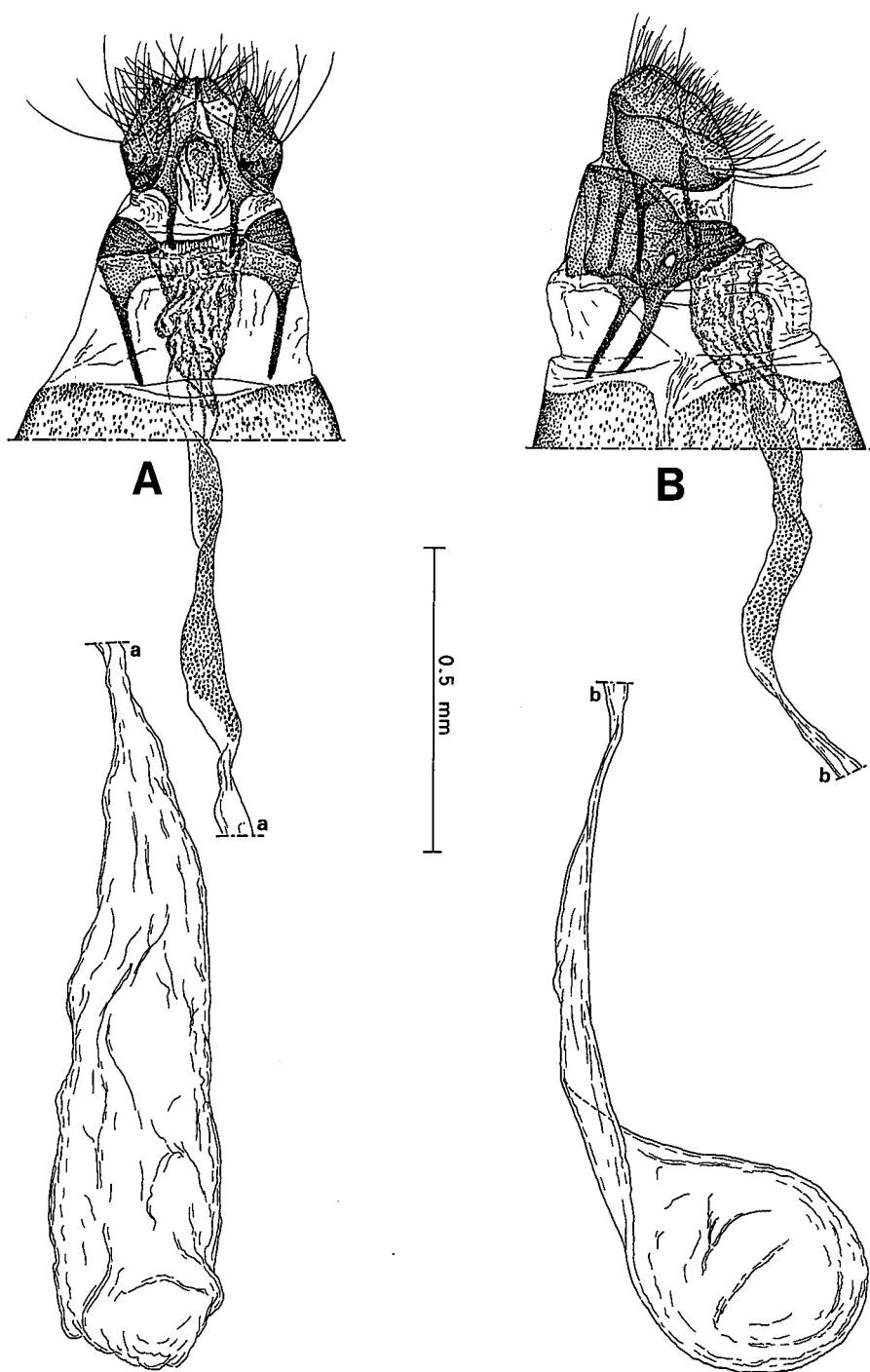


Fig. 8. Female genitalia of *Artifodina japonica* sp. nov. A: Ventral view [Kii-Ōsima, Wakayama-ken, Japan, Sl. no. Grc-1112]—B: Lateral view [Ditto, Sl. no. Grc-1645].

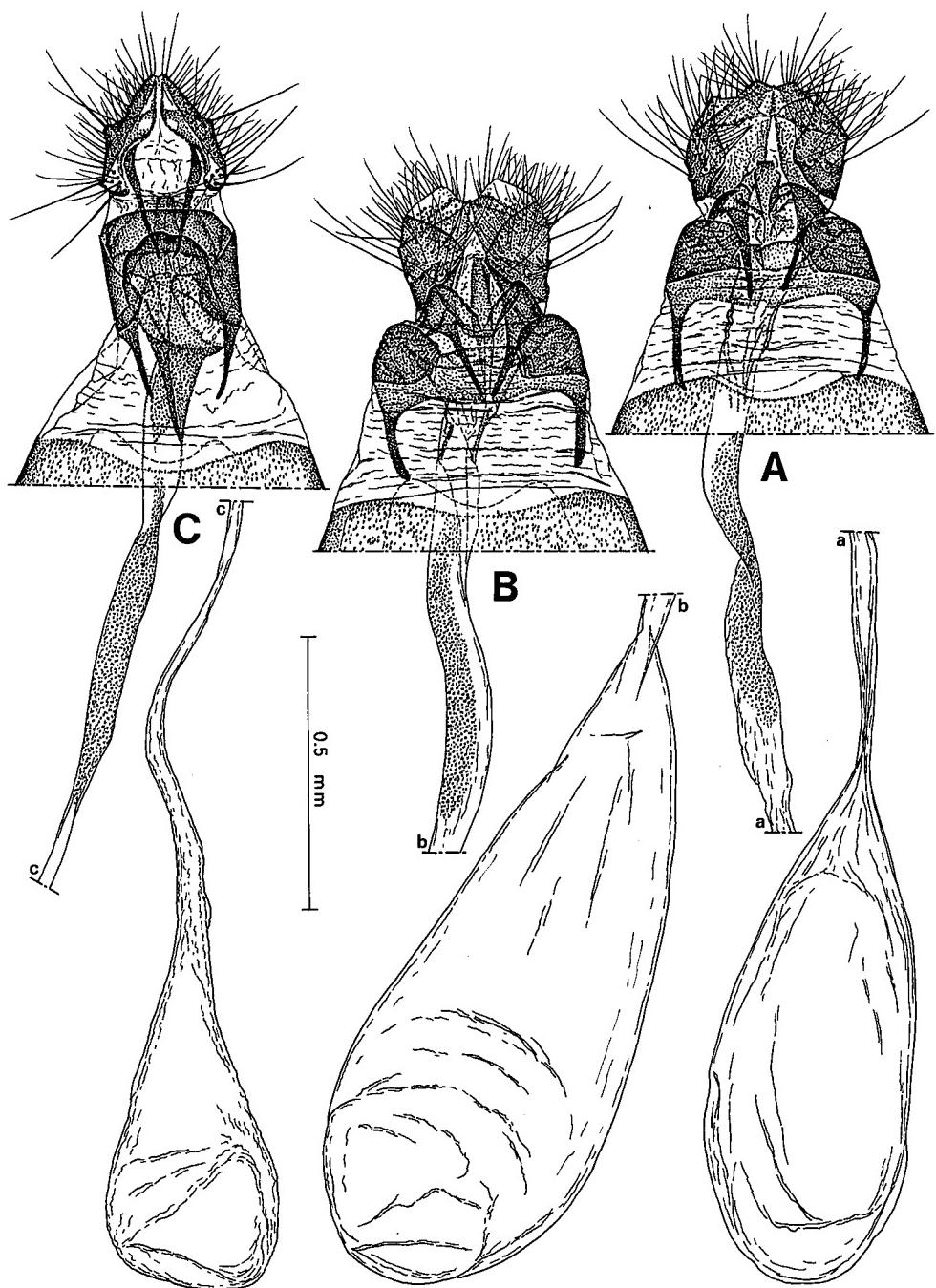


Fig. 9. Female genitalia of *Artifodina*-species. A : *Artifodina strigulata* sp. nov., ventral view [Cherrapunjee, Meghalaya, India, Sl. no. Grc-2277]—B : Ditto [Ditto, Sl. no. Grc-2304]—C : *Artifodina himalaica* sp. nov., ventral view [Balaju, Bagmati, Nepal, Sl. no. Grc-1479].

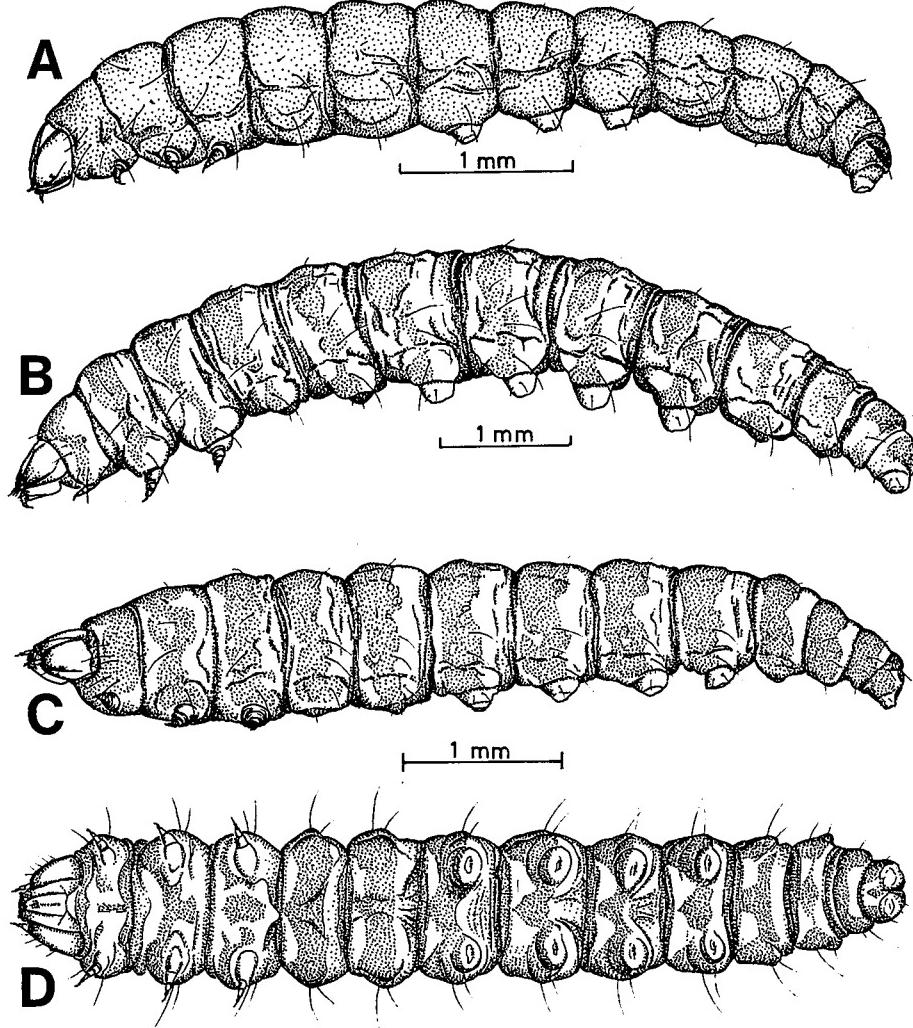


Fig. 10. Last instar larva. A : *Acrocercops transecta* Meyrick, lateral view [Misumai, Sapporo, Hokkaidō, Japan, ex *Juglans ailanthifolia*]—B : *Artifodina japonica* sp. nov., lateral view [Kii-Ōsima, Wakayama-ken, Japan, ex *Myrsine sequinii*]—C : *Artifodina himalaica* sp. nov., lateral view [Siwapuri, Bagmati, Nepal, ex *Myrsine semiserrata*]—D : Ditto, ventral view [Ditto].

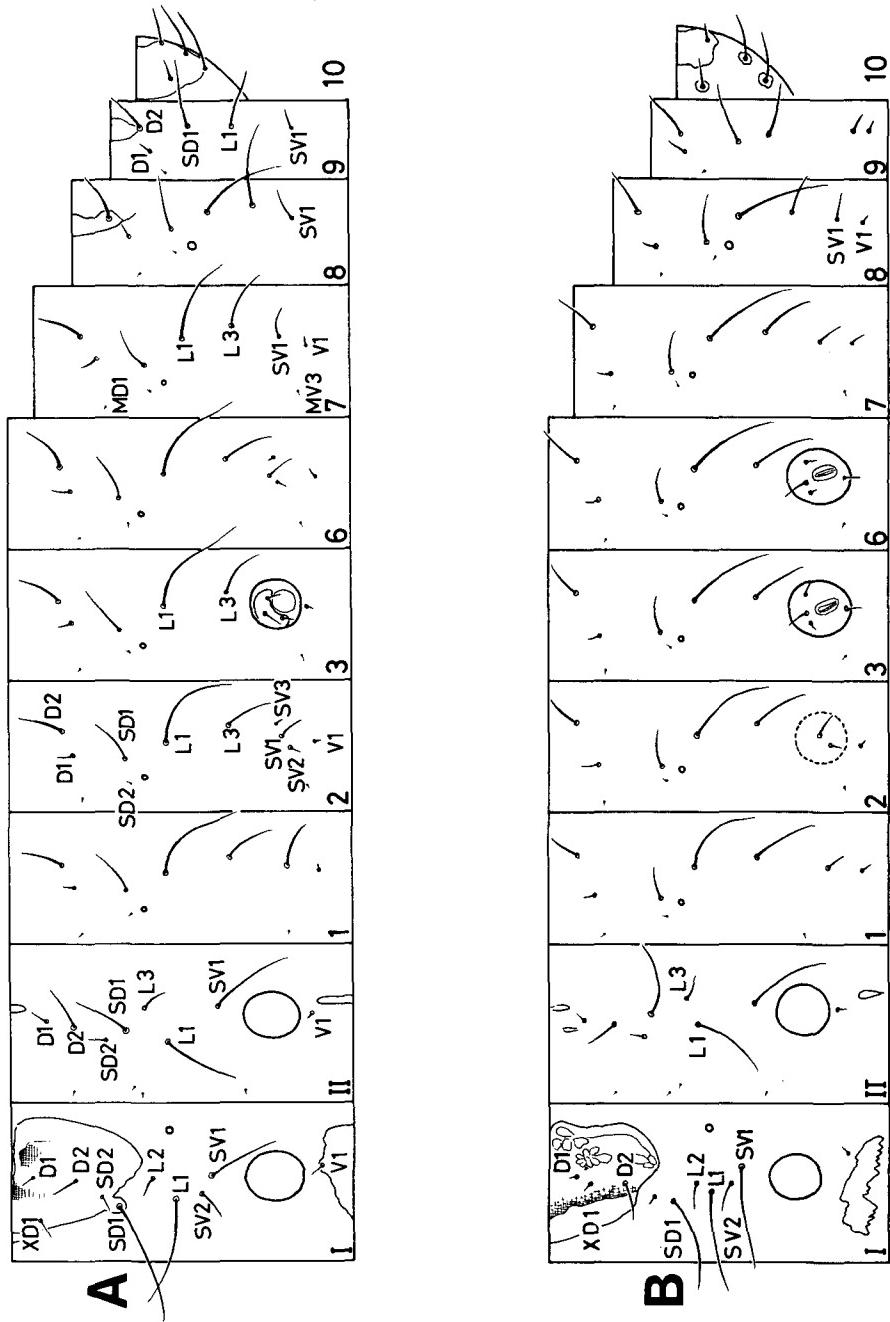


Fig. 11. Body chaetotaxy of last instar larva. A: *Acrocercops transecta* Meyrick [Misumai, Sapporo, Hokkaidō, Japan, ex *Juglans ailanthifolia*]—B: *Artifodina japonica* sp. nov. [Nati, Wakayama-ken, Japan, ex *Myrsine seguinii*].

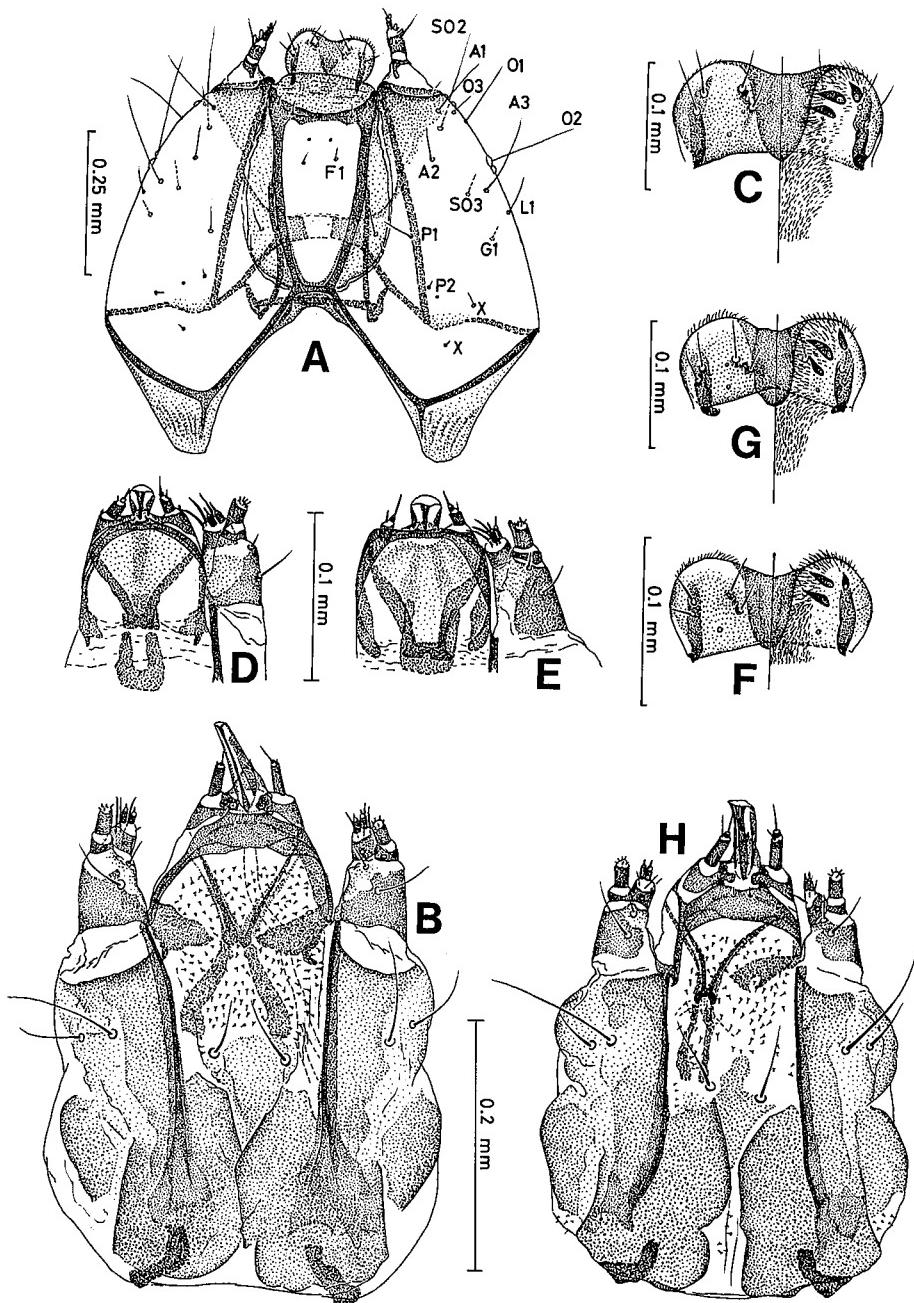


Fig. 12. Larva of tissue-feeding form.

A-D: *Artifodina japonica* sp. nov. —A: Head of supposed 6th (last) instar, dorsal view (mandible and labiomaxillary complex omitted)—B: Labiomaxillary complex of last instar, ventral view—C: Labrum of last instar, left half in dorsal view and right half in ventral view—D: Apical part of labiomaxillary complex of supposed 5th instar.  
 E-F: *Artifodina strigulata* sp. nov. E: Apical part of labiomaxillary complex of supposed 5th (first tissue-feeding) instar—F: Labrum of supposed 5th instar.  
 G-H: *Artifodina himalaica* sp. nov. G: Labrum of last instar—H: Labiomaxillary complex of last instar.

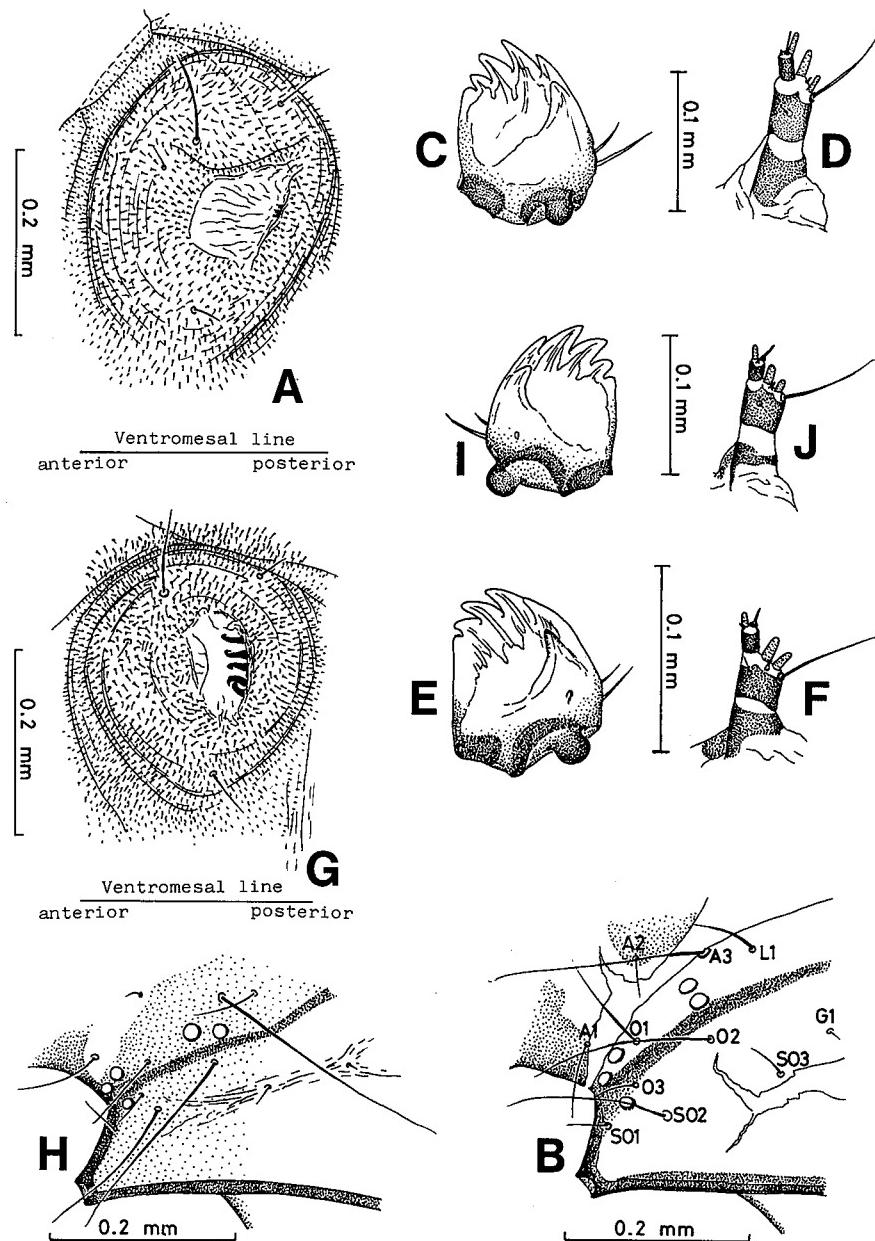


Fig. 13. Larva of tissue-feeding form.

A-D: *Artifodina japonica* sp. nov. A: Sixth abdominal proleg of last instar—B: Ocellar area of last instar—C: Mandible of last instar—D: Antenna of last instar.

E-F: *Artifodina strigulata* sp. nov. E: Mandible of first tissue-feeding instar—F: Antenna of first tissue-feeding instar.

G-J: *Artifodina himalaica* sp. nov. G: Fourth abdominal proleg of last instar—H: Ocellar area of last instar—I: Mandible of last instar—J: Antenna of last instar.

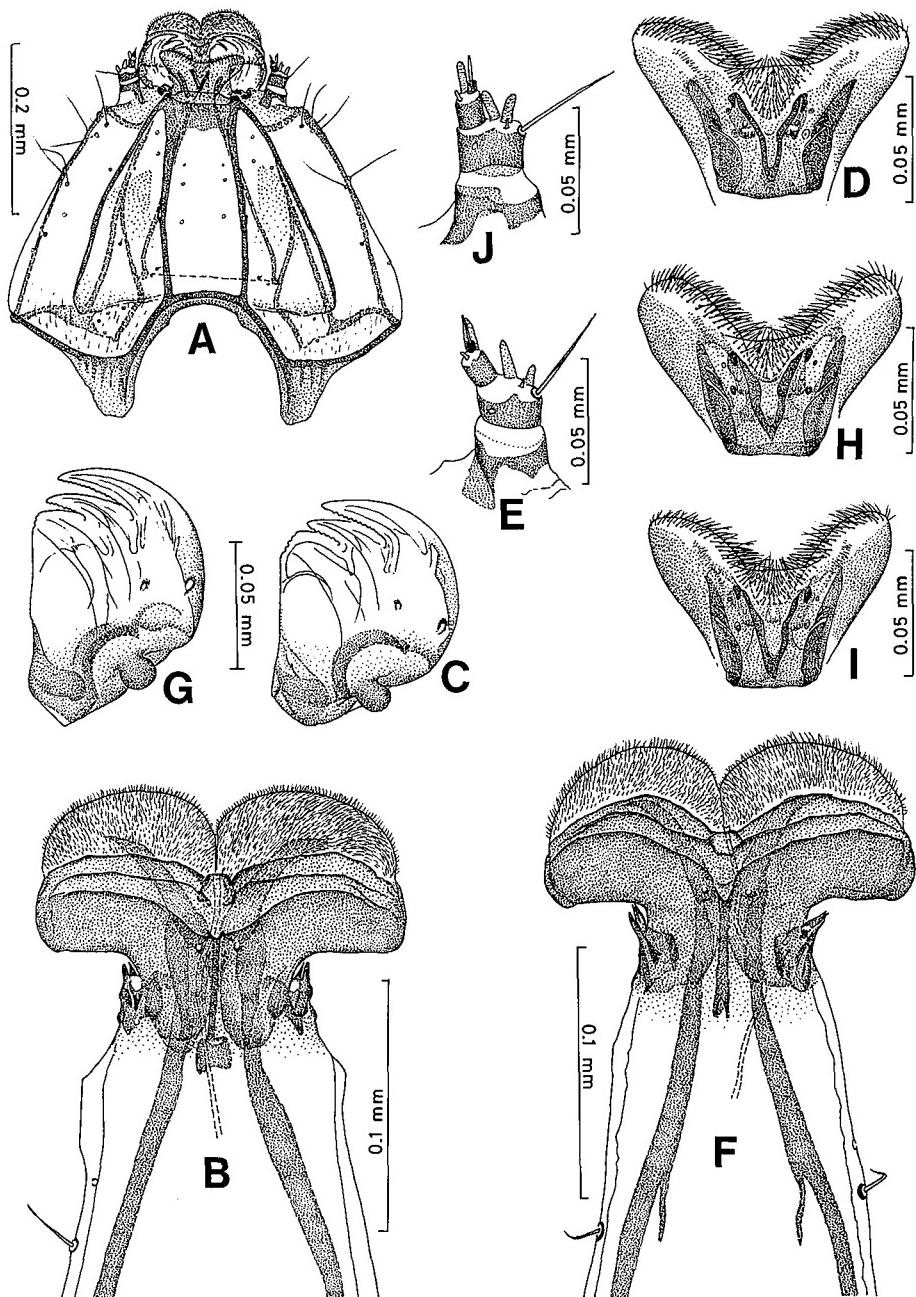


Fig. 14. Larva of sap-feeding form.

A-E: *Artifodina japonica* sp. nov. A: Head of supposed 4th (last sap-feeding) instar, dorsal view—B: Apical part of labiomaxillary complex of supposed 4th instar, ventral view—C: Mandible of supposed 4th instar—D: Labrum of supposed 4th instar—E: Antenna of supposed 4th instar.

F-J: *Artifodina strigulata* sp. nov. F: Apical part of labiomaxillary complex of supposed 4th instar, ventral view—G: Mandible of supposed 4th instar—H: Labrum of supposed 4th instar—I: Ditto—J: Antenna of supposed 4th instar.

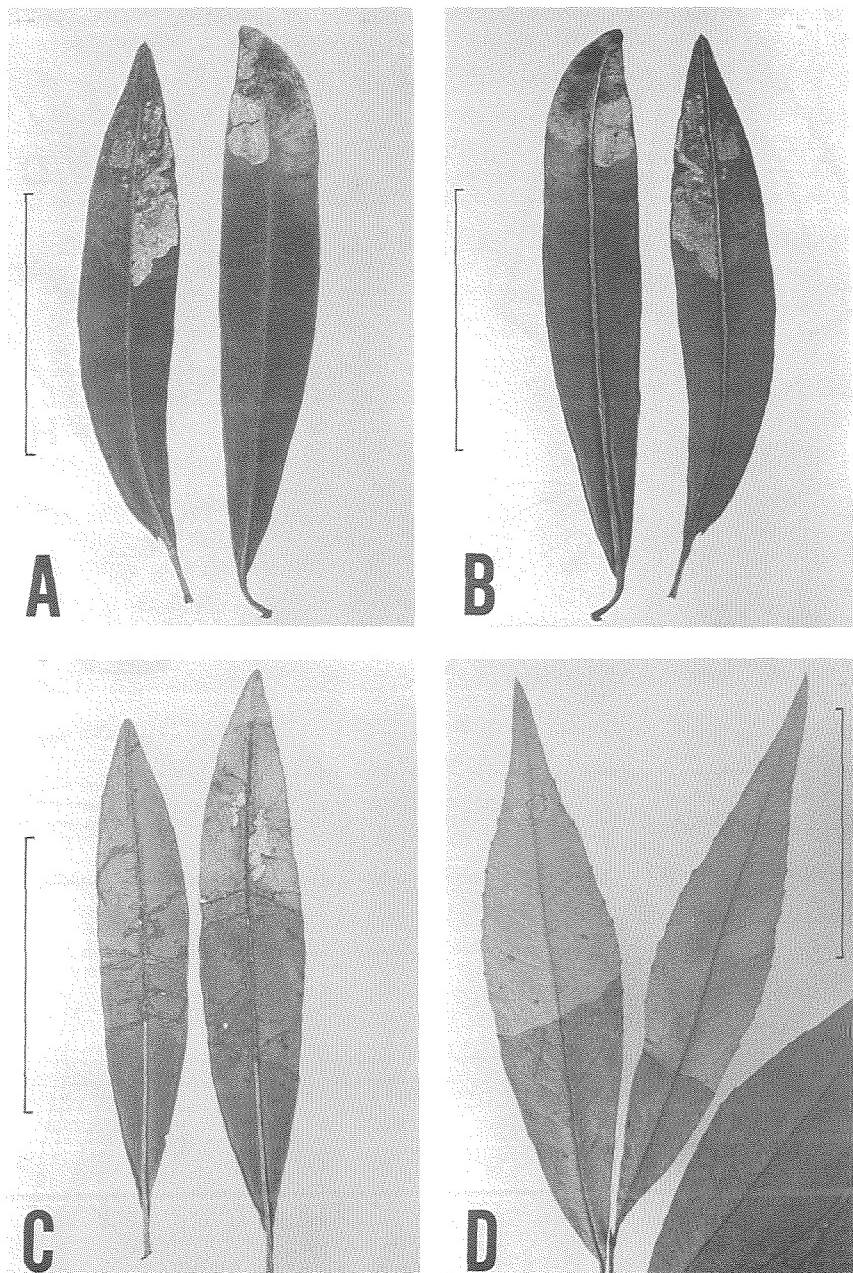


Fig. 15. Leaf-mines (scale : 5 cm). —A : Leaves of *Myrsine seguinii* (upper side) mined by larvae of *Artifodina japonica* sp. nov. [breeding no. 1337]—B : Ditto (lower side)—C : Ditto (lower side), mining part dissected [breeding no. 836]—D : Leaves of *Myrsine semiserrata* (upper side) mined by young larvae of *Artifodina himalaica* sp. nov. [breeding no. Npl-219].

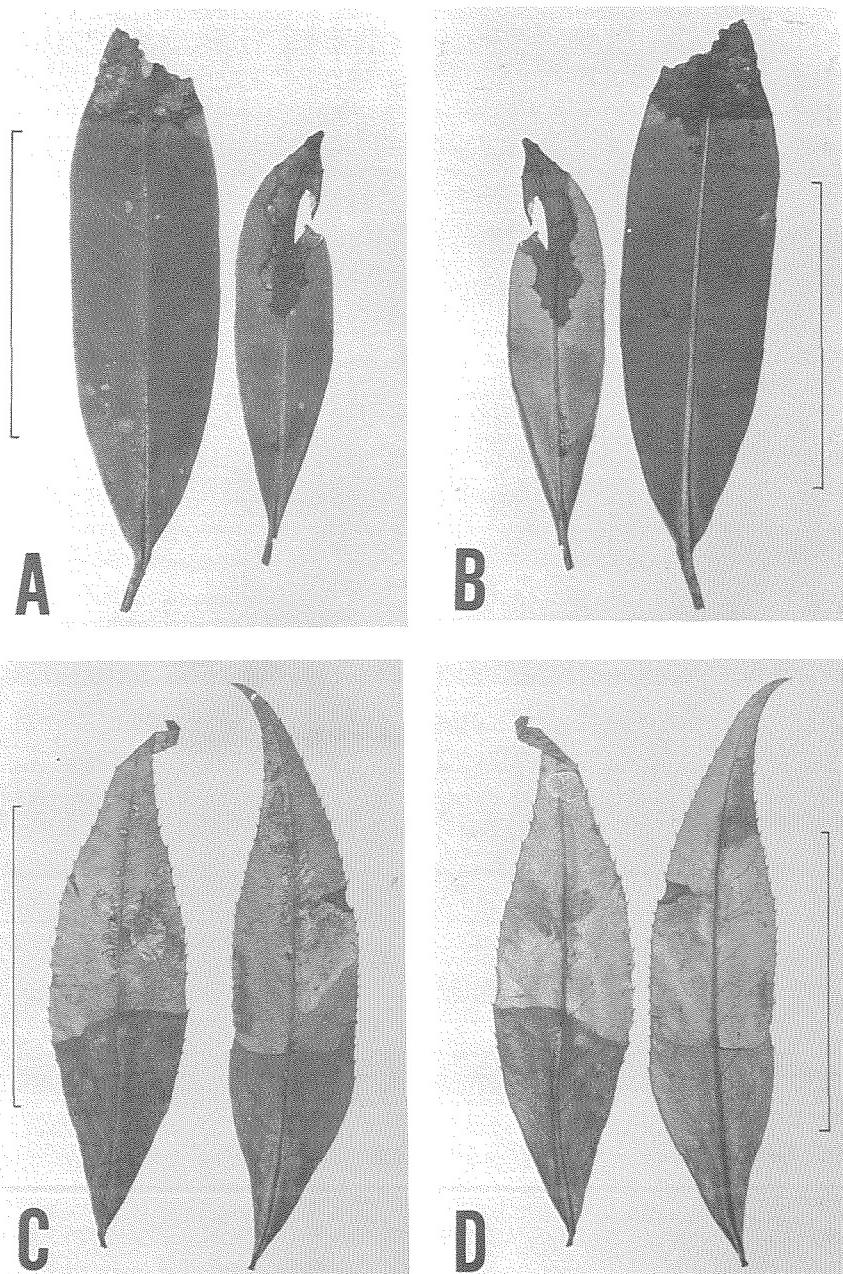


Fig. 16. Leaf-mines (scale : 5 cm). A : Leaves of *Myrsine capitellata* (upper side) mined by larvae of *Artifodina strigulata* sp. nov. [breeding no. Ind-85]—B : Ditto (lower side)—C : Leaves of *Myrsine semiserrata* (upper side) mined by larvae of *Artifodina himalaica* sp. nov. [breeding no. Npl-331]—D : Ditto (lower side).